

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (currently amended): An apparatus for measuring a constituent content of an agricultural product, comprising:

a device for forming a stream of the agricultural product;

an optical sensing window in the device allowing passage of radiation from a radiation source to pass through the stream of agricultural product to a receiver, the optical sensing window being configured, in comparison to the device, to provide a narrower passageway for the stream of agricultural product to provide for a more uniform consistency in the stream of agricultural product for passing the stream of the agricultural product;

a radiation source for irradiating the stream of the agricultural product as the stream of the agricultural product passes through the optical sensing window;

a receiver for receiving radiation transmitted from the radiation source through the stream of agricultural product and the optical sensing window, through the stream of the agricultural product and for converting the received radiation into a corresponding electrical signal; and

a computer, coupled to the receiver, for receiving the electrical signal and for processing the electrical signal to generate data for use in determining a constituent content of the agricultural product.

Claim 2 (currently amended): The apparatus of claim 1 wherein the receiver includes:

a fiber optic cable;

a sensor head for receiving the radiation transmitted from the radiation source through the stream of agricultural product and the optical sensing window, through the stream of the agricultural product and for focusing the received radiation onto the fiber optic cable; and

a spectrometer, coupled to the fiber optic cable, for converting the received radiation into the corresponding electrical signal.

Claim 3 (original): The apparatus of claim 2 wherein the fiber optic cable comprises a single fiber optic cable.

Claim 4 (original): The apparatus of claim 2 wherein the sensor head includes:

a fiber optic probe coupled to the fiber optic cable; and

a plurality of optical lenses positioned between the optical sensing window and the fiber optic cable for focusing the received radiation onto the fiber optic probe.

Claim 5 (original): The apparatus of claim 1, further including a housing for containing the device, the radiation source, the optical sensing window, and the receiver.

Claim 6 (original): The apparatus of claim 5, further including a fan mounted within the housing.

Claim 7 (original): The apparatus of claim 1, further including an inlet, coupled to the device, for attachment to a source providing the agricultural product.

Claim 8 (original): The apparatus of claim 7 wherein the inlet is configured to receive the agricultural product from a combine.

Claim 9 (original): The apparatus of claim 1 wherein the device receives the agricultural product from a grain pipe.

Claim 10 (original): The apparatus of claim 1 wherein the optical sensing window includes:

an inner wall;

an outer wall; and

a pair of side walls,

wherein the inner wall, the outer wall, and the pair of side walls are joined to form a passageway for the agricultural product.

Claim 11 (original): The apparatus of claim 10 wherein:

the inner wall is formed from an optically transparent material; and

the outer wall and the pair of side walls are formed from an opaque material.

Claim 12 (original): The apparatus of claim 11 wherein the inner wall includes:

- a front planar section; and
- a pair of curved edges.

Claim 13 (original): The apparatus of claim 10 wherein the outer wall includes a transparent aperture for permitting the radiation to pass through the stream of the agricultural product and to the receiver.

Claim 14 (currently amended): A method for measuring constituent contents of an agricultural product, comprising:

- forming a stream of the agricultural product;
- passing the stream of the agricultural product through an optical sensing window
- allowing passage of radiation from a radiation source to pass through the stream of agricultural product to a receiver, the optical sensing window being configured, in comparison to the device, to provide a narrower passageway for the stream of agricultural product to provide for a more uniform consistency in the stream of agricultural product;
- irradiating the stream of the agricultural product as the stream of the agricultural product passes through the optical sensing window;
- receiving radiation transmitted from the radiation source through the stream of agricultural product and the optical sensing window, through the stream of the agricultural product and converting the received radiation into a corresponding electrical signal; and
- receiving the electrical signal and processing the electrical signal to generate data for use in determining a constituent content of the agricultural product.

Claim 15 (original): The method of claim 14 wherein the receiving radiation step includes:

- receiving the radiation transmitted through the stream of the agricultural product and focusing the received radiation onto a fiber optic cable; and
- converting the received radiation from the fiber optic cable into the corresponding electrical signal.

Claim 16 (original): The method of claim 15 wherein the receiving the radiation step includes focusing the received radiation onto a single fiber optic cable.

Claim 17 (original): The method of claim 14 wherein the receiving radiation step includes using a plurality of optical lenses for focusing the received radiation onto a fiber optic probe coupled to the fiber optic cable.

Claim 18 (original): The method of claim 14, further including providing an inlet for attachment to a source providing the agricultural product.

Claim 19 (original): The method of claim 18 wherein the providing step includes configuring the inlet to receive the agricultural product from a combine.

Claim 20 (original): The method of claim 13, further including receiving the agricultural product from a grain pipe.

Claim 21 (original): A method for converting a light signal into an electrical signal for use in predicting a constituent content of an agricultural product, comprising:

- receiving a light signal from an agricultural product;

- converting the light signal into an electrical signal;

- digitizing the electrical signal to produce a plurality of data points; and

- normalizing the data points using a reference signal value to produce a plurality of normalized data points, the normalized data points having values related to a constituent content of the agricultural product, wherein the reference signal value is related to a magnitude at a wavelength of the light signal substantially unaffected by the constituent content.

Claim 22 (original): The method of claim 21 wherein the normalizing step includes using, as the reference signal value, a value derived from the magnitude using a mathematical function.

Claim 23 (original): The method of claim 21 wherein the normalizing step includes using as the reference signal value a value related to magnitudes at a plurality of wavelengths including the wavelength of the light signal substantially unaffected by the constituent content.

Claim 24 (original): The method of claim 21 wherein the normalizing step includes using as the reference signal value an average magnitude value of a range of magnitude values at a pair of wavelengths centered around the reference wavelength.

Claim 25 (original): The method of claim 21, further including predicting protein content of the agricultural product using the plurality of normalized data points.

Claim 26 (original): The method of claim 21, further including:

- receiving geographical coordinates corresponding with a geographical location of the agricultural product; and

- associating the geographical coordinates with the constituent content of the agricultural product.

Claim 27 (original): The method of claim 26, further including:

- receiving a plurality of geographical coordinates corresponding with geographical locations of a plurality of agricultural products for which the constituent contents are predicted using the method; and

- associating the plurality of geographical coordinates with the constituent contents of the plurality of agricultural products.

Claim 28 (original): The method of claim 27, further including generating a map of the constituent content of the agricultural products using the plurality of geographical coordinates and the associated constituent contents.

Claim 29 (original): The method of claim 28 wherein the generating step includes generating a grid map.

Claim 30 (original): The method of claim 28 wherein the generating step includes generating a contour map.

Claim 31 (original): The method of claim 21, further including calculating average values for the data points and wherein the normalizing step includes normalizing the average values.

Claim 32 (original): The method of claim 21, further including linearizing the normalized data points.

Claim 33 (original): The method of claim 32 wherein the linearizing step includes calculating a logarithm of each of the data points.

Claim 34 (original): The method of claim 21 wherein the receiving step includes receiving the light signal from moving stream of the agricultural product.

Claim 35 (original): The method of claim 21 wherein the receiving step includes receiving the light signal from a stopped stream of the agricultural product.

Claim 36 (original): A method for converting a light signal into an electrical signal for use in predicting a constituent content of an agricultural product, comprising:

- receiving a light signal from an agricultural product;
- converting the light signal into an electrical signal;
- digitizing the electrical signal to produce a plurality of data points; and
- normalizing the data points using a reference signal value to produce a plurality of normalized data points, the normalized data points having values related to a constituent content of the agricultural product, wherein the reference signal value corresponds with a magnitude of a received light signal at a specific wavelength without being transmitted through the agricultural product.

Claim 37 (original): A method for converting a light signal into an electrical signal for use in predicting a constituent content of an agricultural product, comprising:

receiving a light signal from an agricultural product;
converting the light signal into an electrical signal;
digitizing the electrical signal to produce a plurality of data points; and
normalizing the data points using a reference signal value to produce a plurality of
normalized data points, the normalized data points having values related to a constituent content
of the agricultural product, wherein the reference signal value corresponds with a magnitude of a
received light signal transmitted through a gating mechanism and without being transmitted
through the agricultural product.

Claim 38 (original): An apparatus for measuring a constituent content of an agricultural product,
comprising:

- a device for forming a stream of the agricultural product;
- an optical sensing window in the device for passing the stream of the agricultural
product;
- a radiation source contained within the housing for irradiating the stream of the
agricultural product as the stream of the agricultural product passes through the optical sensing
window;
- a receiver for receiving radiation transmitted through the stream of the agricultural
product and for converting the received radiation into a corresponding electrical signal; and
- a computer, coupled to the receiver, for receiving the electrical signal and for processing
the electrical signal to generate data for use in determining a constituent content of the
agricultural product, the computer operating to:
 - digitize the electrical signal to produce a plurality of data points; and
 - normalize the data points using a reference signal value to produce a plurality of
normalized data points, the normalized data points having values related to a constituent
content of the agricultural product, wherein the reference signal value is related to a
magnitude at a wavelength of the light signal substantially unaffected by the constituent
content.

Claim 39 (original): The apparatus of claim 38 wherein the computer operates to use, as the
reference signal value, a value derived from the magnitude using a mathematical function.

Claim 40 (original): The apparatus of claim 38 wherein the computer operates to use as the reference signal value a value related to magnitudes at a plurality of wavelengths including the wavelength of the light signal substantially unaffected by the constituent content.

Claim 41 (original): The apparatus of claim 38 wherein the computer operates to use as the reference signal value an average magnitude value of a range of magnitude values at a pair of wavelengths centered around the reference wavelength.

Claim 42 (original): The apparatus of claim 38 wherein the computer operates to predict protein content of the agricultural product using the plurality of normalized data points.

Claim 43 (original): The apparatus of claim 38 wherein the computer operates to normalize the data points selectively using one of the following plurality of reference signal values: a magnitude at a wavelength of the light signal substantially unaffected by the constituent content, a magnitude of a received light signal without being transmitted through the agricultural product at specific wavelengths, or a magnitude of a received light signal transmitted through a gating mechanism and without being transmitted through the agricultural product.